

CPS: Breakthrough: Securing Smart Grid by Understanding Communications Infrastructure Dependencies Award #: 1545037, Date; 10/2015; PI: Sajal K. Das, Missouri Univ. of Science and Technology (Co-PIs: Simone Silvestri, Marisa Crow)

Challenge:

- Characterize interdependence between electric grid and communication systems
- Secure advanced metering infrastructure (AMI) against various types of data integrity (e.g., false data injection) attacks
- Accurately distinguish compromised vs. non/ compromised smart meters (IoT devices)
- Build robust consensus for anomaly detection and attack mitigation

Novel Solution:

- Entropy based Trust Model with binary evidence (Supervised)
- Folded Gaussian Trust with multinomial evidence (Semi-Supervised)
- Information Theoretic Diversity Index based approach (Unsupervised)
- Privacy-preserving anomaly detection, high accuracy, low false alarm

Project 1545037 Missouri S&T, PI: Sajal K. Das (sdas@mst.edu)



Scientific Impact:

Broader Impact:

• Novel data-driven approach to anomaly detection across CPS and IoT domains including smart grid and transportation • Transform observed time series data into a Gaussian mixture model

• Define a **new Stable Invariant** –

Harmonic Mean to Arithmetic Mean ratio • Validate with real traces: 800 houses in Austin, TX; 5,000 houses Dublin, Ireland

• Proposed defense against data integrity attacks is robust; persistent attackers will take 5.5 years to succeed.

• Developed a new course "Advances in CPS"; Trained one Postdoc, two PhDs, and three undergrad students

Resulted in SaTC and JUNO2 projects

 Organized Big Data and IoT Security Workshop (2017-21); Delivered several Keynote and invited seminar talks • Published 1 book, 10 journal articles

and 12+ conference papers